Nitrous Oxide
Use In Children

‘Relief of pain is a basic need and right of all children’ (Whaley and Wong, 1999; 1159).

Competency Based Learning Package

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Learning Package Nitrous Oxide Administration

Introduction

Pain and Children
Paediatric nursing emphasises the importance of the traumatic effects that painful procedures may have on children (Bruce and Franck, 2000; Paris, 1996). There is an increasing focus on the need to minimise traumatic procedural pain for the paediatric population. Paediatric nurses have many techniques available to them to achieve this, including both pharmacological and non-pharmacological methods. All pharmacological methods of pain control have attendant risks and these must be weighed against the benefits to be gained from their use.

Medical adjuncts to pain control in children include medications to relieve the pain (analgesics) and anxiety (anti-anxiolytics) associated with a procedure, or to alter the child’s experience of the procedure to decrease the associated trauma (amnesics and dissociative anaesthetics). These medications may be given by a variety of routes including sub cutaneous, intramuscular, intravenous, intranasal or topical.

In conjunction with medication there are a variety of non-drug options that may be successfully used to relieve the trauma of procedural pain. These include hypnosis, imagery, distraction, play therapy and story telling amongst others. All of these techniques can be employed in conjunction with most forms of drug therapies short of general anaesthesia. Many of these techniques are extremely useful as adjuncts to the use of Nitrous Oxide in children.

Background
Nitrous Oxide (N₂O) has a history of effective use as an analgesic, amnesic, anti-anxiolytic used for both adults and for children (Paris, 1996; Kanagasundaram et al, 2001; Bruce, 2003). It has been commonly used in dental practice (Haas, 1999) as well as for medical procedures (Procedural Pain Program – Comfort Kids, 2008; Kennedy et al, 2004; Clinical Affairs Committee, 2003; Street, 2000; Wertz, 1994). It can be used as either a 50:50 premixed combination of Nitrous Oxide and Oxygen (Street, 2000) or as a variable mixture controlled by the operator through a flow mixer (up to 70% N₂O/30% O₂). Its use, safety and effectiveness in paediatric practice is increasingly being recognised (Babl et al, 2008).

Policy
The Launceston General Hospital has developed a policy for the use of Nitrous Oxide/Oxygen combinations for paediatric patients in both the Paediatric Unit and the Department of Emergency Medicine (Guidelines and Procedures – Administration of Nitrous Oxide to Paediatric Patients, 2010; Appendix A). This has been modelled using the policies of the Royal Children’s Hospital Melbourne (General Medicine and Emergency Department, 2001) and the Children’s Hospital, Westmead, Policies for the Administration of Nitrous Oxide (Division of Nursing, 2001) and reviewed using current literature available.

Who Can Administer?
Trained personnel must supervise the use of Nitrous Oxide (Babl et al, 2005; Street, 2000; Haas, 1999; Wertz, 1994). Anaesthetic medical staff may administer Nitrous Oxide. All other staff must be trained to administer Nitrous Oxide. Training is offered to

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both Nursing and Medical staff through the Clinical Educators within the Paediatric Unit. Staff must have at least 12 months experience in paediatrics (Division of Nursing 2001) to undertake the training. They must also have a current paediatric resuscitation assessment completed (Bruce, 2003; Anesthesia Patient Safety Foundation, 2003).

| Training consists of: (Frampton et al, 2003; Division of Nursing, 2001; Pickup and Pagdin, 2000/2001; Bruce and Franck, 2000) | • Attendance at inservice education session on N₂O
• Completion of the Learning Package and Written Assessment
• Demonstration of practical ability with the technique by at least 3 witnessed supervised administrations of Nitrous Oxide (Appendix B). |

Once accredited to administer Nitrous Oxide, staff will maintain administration records (Appendix C) of all occasions of use for the purpose of annual updating of accreditation. Maintaining their records of accreditation and administration will be the responsibility of the individual registered nurse. Absence of documented administrations will mean that staff undergo re accreditation for the administration of Nitrous Oxide. Updating of accreditation records will be coordinated through the Clinical Nurse Manager or Clinical Educator of the Unit or the Divisional Director of Paediatrics.

Approval for staff to administer Nitrous Oxide to children is obtained from the Director of Paediatrics. No staff will be permitted to administer Nitrous Oxide without current documented approval.

**Nitrous Oxide**

*Indications for Use*

There is a range of uses in the clinical setting for Nitrous Oxide. Its role as a sedative, analgesic/ anxiolytic for procedural use is well recognised. Some specific indications for its use include wound debridement, suturing, dressing, manipulation of fractures and dislocations (Babl et al, 2005; Street, 2000; General Medicine and Emergency Department, 2001), cannulation, bone marrow aspiration, lumbar puncture (Kanagasundaram et al 2001). Evidence has also been demonstrated for its use in radiological sedation (Pershad and Gilmore, 2006).

*Effects on Patients*

Nitrous Oxide’s effects are well documented but the effects can be variable and the analgesia and sedation provided may not be sufficient for some patients (Procedural Pain Program – Comfort Kids, 2008).

Nitrous oxide produces relaxation, and may also induce light headedness, body warmth, tingling of the hands and feet, circumoral numbness and euphoria (Kennedy et al, 2004; Haas, 1999; Street, 2000). Ear ache, dry mouth, dizziness and nausea and vomiting are also potential side effects (Bruce, 2003). Mild analgesia also results but is not a substitute for adequate local analgesia for procedures (Haas, 1999). There may also be some benefit in some procedures by the use of other analgesic methods as ordered by
medical staff. Hearing may be affected and laughing and crying may be exhibited by some children at higher doses (Haas, 1999).

**Pharmacology/Pharmacokinetics**
Nitrous Oxide is a colourless, non explosive gas with sedative, anaesthetic and analgesic activity (Paris, 1996). It is readily absorbed by inhalation with a quick onset of action (1–3 minutes – Procedural Pain Program – Comfort Kids, 2008) and is rapidly eliminated via the lungs (Procedural Pain Program – Comfort Kids, 2008; Babl et al, 2008; Scottish Intercollegiate Guidelines Network, 2004; Frampton et al, 2003; Babl et al, 2005). Rapid elimination allows for ease of reversal in the event of overdosage (Haas, 1999). As it is not metabolised in the body it is almost completely eliminated via the lungs and does not bind to carrier sites avoiding difficulties of drug interactions (Frampton et al, 2003). It is commonly used for general anaesthesia, analgesia, and sedation in obstetrical, surgical and dental settings.

Although the exact mechanism of action is unknown (Procedural Pain Program – Comfort Kids, 2008) Nitrous Oxide appears to work within the pain centres in the brain and spinal cord and by controlling the pain sensation pathways in the body (BOC, 2002).

Nitrous Oxide has an affinity for air containing cavities and will diffuse into them very quickly. This means that if the cavity has rigid walls then the pressure in it will increase, if it does not have rigid walls then the volume in it will increase. These conditions include such things as Lung Cysts, bowel obstructions, middle ear disease and pneumothorax (Procedural Pain Program – Comfort Kids, 2008).

Nitrous Oxide must always be used with at least 30% Oxygen concentration, but may be used at lower levels of Nitrous Oxide concentrations. Combination 70% N\textsubscript{2}O/30% O\textsubscript{2} is appropriate for induction of anaesthesia. General indications for the use of Nitrous Oxide in dentistry suggest concentrations between 20% and 50% N\textsubscript{2}O are sufficient to induce effective conscious sedation and analgesic effects (Haas, 1999). Some literature (see Babl et al, 2008) has raised questions as to the apparent variable effectiveness of 50% mixes of O\textsubscript{2} and N\textsubscript{2}O and the safety of use at higher levels administered by nurses has been supported (Procedural Pain Program – Comfort Kids, 2008; Babl et al, 2008; Frampton et al, 2003). Titrating the dose by 10% is effective in identifying adequate levels of procedural sedation (Procedural Pain Program – Comfort Kids, 2008).

**Diffusion Hypoxia:**
Nitrous oxide is twenty to forty times more soluble in blood than nitrogen and oxygen. When it is discontinued, N\textsubscript{2}O diffuses out of the blood into the alveoli in large volumes. If the patient is allowed to breathe air at this time the combination of N\textsubscript{2}O and nitrogen in the alveoli reduces alveolar PO\textsubscript{2}. This causes diffusion hypoxia and is avoided by administering 100% Oxygen for 3–5 minutes post procedure. If the patient’s mask is off for more than 30 seconds or after discontinuing N\textsubscript{2}O 100% Oxygen should be administered

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Procedural Pain Program – Comfort Kids, 2008
Interactions
In all cases where patients are to receive other drugs during the course of Nitrous Oxide administration medical review should be sought prior to commencing the procedure (Frampton et al, 2003). Combinations of sedatives and/or analgesic drugs may increase the likelihood of adverse outcomes, especially ventilatory depression and hypoxaemia (Anesthesia Patient Safety Foundation, 2003).

Nursing staff will not administer Nitrous Oxide to children who have been given Intravenous opioids or sedatives.

Use of Tobramycin, Kanamycin, Neomycin, and Streptomycin concurrently with Nitrous Oxide may also increase the risk of respiratory depression.

Contraindications/ Precautions
There are no absolute contraindications to the use of N$_2$O, however it should NEVER be administered without Oxygen (Procedural Pain Program – Comfort Kids, 2008).

Precaution should be taken in patients who have –
- Hypovolaemia, shock, cardiac disease
- Air embolism, pneumothorax, pulmonary air cysts, intestinal obstruction
- Increased intracranial pressure, head injury, loss of consciousness
- Intoxication with drugs or alcohol
- Ear infections/ recent ear surgery – Nitrous oxide increases middle ear pressure and may lead to perforation of the tympanic membrane.
- Respiratory disease – especially adults with chronic obstructive airways disease who may not tolerate the high levels of inspired oxygen that accompany the technique (Haas, 1999; Paris, 1996)
- Head injury with loss of consciousness/ altered conscious state
- Current acute asthma episode
- Maxillofacial injuries

(Procedural Pain Program – Comfort Kids, 2008; Babl et al, 2005; Scottish Intercollegiate Guidelines Network, 2004; Bruce, 2003; Haas, 1999; Street, 2000; General Medicine and Emergency Department, 2001; BOC, 2002)

Nursing staff will not administer Nitrous Oxide to children (Division of Nursing, 2001)

- Under the age of 12 months
- With facial or airway burns
- Who have been given Intravenous opioids or sedatives as premedication

In these cases only medical staff with advanced training in paediatric airway management should administer Nitrous Oxide to the child, if it is appropriate to do so.

Adverse Effects
Nitrous Oxide has relatively few affects on other systems when used alone and in doses usually associated with conscious sedation (Haas, 1994). Most adverse affects are associated with prolonged use/ exposure or abuse of Nitrous Oxide.

Prolonged N2O use may inhibit Vit B12 synthesis and folate metabolism. Repeated use (>3 times per week - Procedural Pain Program – Comfort Kids, 2008) may result in prolonged inhibition of these pathways (Procedural Pain Program – Comfort Kids,
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2008). Therefore significant caution should be utilised in patients on other Folate pathway medications (eg Methotrexate). Folinic acid supplementation may be considered (Procedural Pain Program – Comfort Kids, 2008).

- Bone Marrow depression may result from longer term use (has been recorded with as little as 3 consecutive days of use)
- Arrhythmias
- Myeloneuropathy/ Neuropathy – Numbness, paraesthesia, ataxia. Usually occurs with prolonged exposures
- Delirium
- Seizures
- Nausea and vomiting
- Apnoea/ asphyxia
- Abuse/ Chronic exposure
  - Anaemia, polyneuropathy, bone marrow depression, possible reproductive changes
  - Abuse – numbness/ tingling in extremities, hypoactive reflexes, impaired gait, ataxia, weakness
  - May produce dependence and withdrawal akin to opioid dependence and withdrawal

(Procedural Pain Program – Comfort Kids, 2008; Babl et al, 2005; Haas, 1999; Schumann, 1990; Green, 1996; BOC, 2002)

| Remember | All types of conscious sedation may lead to oversedation and this may compromise the child’s airway. |

It is suggested that patients receiving ongoing treatment with Nitrous Oxide and health care workers utilising Nitrous Oxide in their practice be regularly monitored for blood dyscrasias. The use of scavenging equipment during all procedures involving Nitrous Oxide is recommended (Babl et al 2005; Bruce, 2003; Clark, Renehan and Jeffers, 1997; Paris, 1996; Smith, 1998; BOC, 2002).

Relative Analgesia and Associated Principles

Conscious Sedation

Levels of sedation can be described as a continuum from ‘simple anxiety reduction with minimal depression of consciousness to …general anaesthesia’ (Wertz, 1994; 18). These are generally grouped into three levels –

- Conscious (or light) sedation
- Deep sedation
- General Anaesthesia

Nitrous Oxide for procedural use in paediatrics is directed at the first of these categories. At the level of conscious sedation pain perception is decreased, as is awareness of the surrounding environment. Anxiety is also decreased. The child/ adult should remain responsive to verbal and physical stimulation, vital signs should remain stable and the airway should remain patent (Wertz, 1994; Haas, 1999).
Concomitant use of other forms of sedation and analgesia increase the risk of oversedation, especially those involving opioid analgesics (Scottish Intercollegiate Guidelines Network, 2004).

**Patient Cooperation**
Nitrous Oxide is used as a self administered drug (Bruce, 2003; Pickup and Pagdin, 2000/2001). This means that effective use is determined by the child’s cooperation in using the technique (Wertz, 1994; Haas, 1999). Children must be able to hold the mask to their face and inhale the gas (Bruce, 2003; General Medicine and Emergency Department, 2001). This suggests that it is most effective in people of normal cognitive function (Wertz, 1994). The lower age limit for use remains open, varying depending on the individual child and the procedure to be performed (Bruce, 2003). Some authors suggest it can be used in children over the age of 8 years (Wertz, 1994). Kanagasundaram et al (2001) suggest that it may be used in children as young as 6 years of age with appropriate teaching, whilst the Royal Children’s Hospital Melbourne (General Medicine and Emergency Department, 2001) suggest children as young as 4 years of age may adequately cope with its use.

**Note:** Children must be able to hold the mask for themselves and inhale the gas. If the child is unable or unwilling to do this an alternative form of analgesia/sedation must be used.

The lower age limit for the use of Nitrous Oxide may be related to the degree of intensity of the pain experienced and the complexity of the procedure (Bruce, 2003; Bruce and Franck, 2000). As the complexity of the procedure increases or the intensity of the pain experience increases, so too will the age of the child need to be higher to achieve adequate co-operation. There are examples of Nitrous Oxide in the form of Entonox being used on younger children but this is usually in the premixed form. The use of Entonox for younger children (premixed 50% N₂O and 50% O₂) is not covered by this package.

Nitrous Oxide can also be useful in children with developmental delay if they can hold the mask to their face. If any child becomes excessively sedated they can no longer self administer, decreasing the risk of overdose or loss of consciousness (Bruce, 2003; Wertz, 1994).

Nursing staff will not administer Nitrous Oxide to any child under the age of 12 months under any circumstance (Division of Nursing, 2001).

Where Nitrous oxide is deemed inappropriate an alternate form of procedural analgesia and sedation must be implemented (Bruce, 2003)
The Quantiflex System

Nitrous Oxide is delivered via the Quantiflex system (Fig. 1) which allows a variable flow rate of between 100% O₂ (black/white cylinder) and 0% N₂O (blue cylinder) to 30% O₂ and 70% N₂O. This is stored in the treatment room on 4K.

Prepackaged disposable mouthpieces including a viral/ bacterial filter, inlet and outlet ports and one way valve on the outflow port (Fig. 2) are available via stores. They also include expandable tubing to connect to the Quantiflex machine. The mouth piece is interchangeable with a standard or flavoured face mask as required. They are stored in the cupboard next to the sink in the Treatment Room. After hours they are also available from Labour Ward (4B) and Department of Emergency Medicine.

Stretching the extendable tubing (Fig 3) provides greater length to connect the mouthpiece/ mask to the Quantiflex machine. The expandable tubing connects directly to the front port of the Quantiflex machine just above the rebreathing bag (Fig. 4). New
stock has blue tubing connecting the quantiflex machine and the mouthpiece/mask, instead of clear tubing.

Pink scavenger tubing comes attached to the mouthpiece (Fig 5). The scavenger tubing attaches to the cylinder at the back of the Quantiflex machine (Fig. 6). Scavenger systems reduce occupational exposure to Nitrous Oxide over long periods of time (Clinical Affairs Committee, 2003).
The suction chamber then attaches directly to wall suction via standard suction tubing (Fig. 7).
The flow mixer (Fig. 8) sits just above the outlet valve for the gas flow where the Quantiflex machine connects to the mask/ mouth piece via the extendable tubing. This can vary the flow of Oxygen from 30% to 100% in mixture with the nitrous oxide.

![Image](nitrous_oxide_learning_package.png)

Fig. 8

Both the Nitrous Oxide and Oxygen cylinders should be switched off at the cylinder regulators when not in use. Once the Nitrous Oxide and Oxygen cylinders are switched on, turning the central black dial in an anti clockwise direction commences the flow of gas. Oxygen flow is indicated by the white flow meter on the right, Nitrous Oxide flow by the blue flow meter on the left. The percentage of Oxygen/ Nitrous Oxide mix is controlled by the white dial located above above the black control dial.

**Procedure**

*Preparation for the Procedure*

The procedure and the use of Nitrous Oxide should be explained to the child and their parents prior to the procedure. It is vital that the child understand and is able to cooperate with the procedure. Parents may be present with the child during their procedure if they wish and if it is medically appropriate for them to attend. Some guidelines encourage the option for relatives to support the child (Scottish Intercollegiate Network, 2004).

The child should be assessed by a medical officer and an order for Nitrous Oxide must be documented. Special notice to assessment should be made for any child with pre-existing cardiac or respiratory conditions, current medications or allergies. These factors may make Nitrous Oxide unsuitable for use with that child.

| Special Note: Assessment | • Previous problems with Anaesthetics
| | • History of stridor, snoring, sleep apnoea
| | • Dysmorphic facial features (eg Trisomy 21, Pierre Robins)
| | • Significant obesity
| | • Neck problems
| (Anesthesia Patient Safety Foundation, 2003)
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The risk of vomiting and aspirating vomitus is always present during a procedure utilising any form of sedation. To minimise this risk children should be fasted prior to elective use of Nitrous Oxide (General Medicine and Emergency Department, 2001; Division of Nursing, 2001; Anesthesia Patient Safety Foundation, 2003). Recommendations for the Launceston General Hospital suggest a minimum fasting time of 4 hours, when this is possible (Department of Health and Human Services, 2003).

Where there is any concern that a child requiring sedation is not appropriate to receive Nitrous Oxide the advice of a member of the anaesthetic staff should be sought.

Equipment

Appropriate resuscitation equipment and trained staff (Scottish Intercollegiate Guidelines Network, 2004) should be available at hand, including suction equipment, oxygen supply, self-inflating bag for artificial ventilation and access to a resuscitation trolley (Australian and New Zealand College of Anaesthetists, 2001, Anesthesia Patient Safety Foundation, 2003).

Check the Quantiflex machine prior to the procedure commencing to ensure it is in working order and there is sufficient gas to complete the procedure.

The Procedure

The procedure is described in Appendix A - Guidelines and Procedures – Administration of Nitrous Oxide to Paediatric Patients (Department of Health and Human Services, 2003).

- Connect all tubing and mask/mouth piece
- Switch on Oxygen and Nitrous Oxide cylinders
- Switch on Regulators
- Switch on Scavenging system
- Instruct child how to use the mask or mouthpiece
- Ensure child maintains satisfactory seal around edge of mask
- Adjust N₂O:O₂ mix to 50:50 initially
  - Rate 3 litres/minute if child < 20 kg
  - Rate 4 litres/minute if child > 20 kg
- Instruct the child to breathe deeply at a normal rate via the mask.
- Child should commence using the mask at least 2-3 minutes prior to commencing the procedure (Division of Nursing, 2001; Pickup and Pagdin, 2000)
- Administrator should constantly observe the child during the procedure to:
  - Ensure child is having effective analgesia
  - Is not asleep
  - Monitor (see monitoring below)
- Oxygen and nitrous oxide mix may be adjusted as needed to promote effective analgesia. As the mix approaches 70% Nitrous Oxide there is a greater risk of sedation so more caution needs to be taken.
- Child should continue breathing Nitrous Oxide/Oxygen until at least 1 minute following the completion of the procedure (General Medicine and Emergency Department, 2001). At this time the child should breathe 100% Oxygen for 2-3

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minutes (Haas, 1999) before returning to their room. All children should remain attended by staff during this period.

- At completion of the procedure ensure all equipment (Nitrous Oxide, Oxygen and scavenging equipment) is switched off.
- Dispose of equipment as required.

**Minimum Standards for Monitoring**

| Monitoring the child while using Nitrous Oxide is the responsibility of the person administering the gas. They have no other role during the procedure (Scottish Intercollegiate Guidelines Network, 2004; Department of Health and Human Services, 2003; Division of Nursing, 2001; Australian and New Zealand College of Anaesthetists, 2001). |

Pre-procedure assessment should be conducted to exclude relative contraindications for use. Pre procedure heart rate and blood pressure should be obtained.

Next to monitoring for effectiveness of pain relief the most important aspect of caring for a child receiving Nitrous Oxide is the monitoring of conscious state (Bruce, 2003; Babl et al 2005). This can be achieved through continual verbal contact with the child during the course of the procedure (Pickup and Pagdin; 2000/2001). Respiratory rate and effectiveness are also important (Babl et al, 2005) Pulse Oximetry is mandatory for all children having Nitrous Oxide (Babl et al, 2005; Division of Nursing, 2001) except where Nitrous Oxide is being used for a burns bath. During administration of Nitrous Oxide patients should be monitored for level of consciousness and adequacy of respiration (Haas, 1999; Wertz, 1994). For all children being sedated it is important to monitor Oxygen saturations, pulse and respirations (Bruce, 2003; Graber, 2002). This should be continued for at least 5 minutes post procedure or until the child returns to baseline neurological state (Scottish Intercollegiate Guidelines Network, 2004; Babl et al, 2005)

**Principles of monitoring**

| Level of Consciousness | • Verbal communication with the child frequently  
|                        | • If their only response is withdrawal to painful stimuli they are DEEPLY sedated (i.e. oversedated – see emergency treatment) |
| Breathing              | • Child is talking  
|                        | • Observe for spontaneous respiratory activity  
|                        | • Auscultation of breath sounds |
| Oxygenation            | • Pulse oximetry (remember there may be a delay of 1 minute between onset of apnoea and reduced oximetry) |
| Cardiac                | • Consider continuous BP, Pulse monitoring or Cardiorespiratory monitoring if appropriate (eg in children with underlying cardiovascular disease or dysrhythmia)  
|                        | (Anesthesia Patient Safety Foundation, 2003) |
Emergencies

Nitrous Oxide is a relatively safe medication with a low level of problems arising from controlled short term use. However all forms of sedation carry risks. All staff utilising Nitrous Oxide for procedural purposes must have current paediatric life support certification (Scottish Intercollegiate Guidelines Network, 2004; Anesthesia Patient Safety Foundation, 2003). Availability of staff trained in advanced paediatric airway support is essential (Anesthesia Patient Safety Foundation, 2003). No procedure requiring Nitrous Oxide should be carried out without a medical officer in the unit, although they do not necessarily need to be in the room where the procedure is occurring.

Detection and initial treatment of any emergency arising from the administration of Nitrous Oxide is the responsibility of the person administering the gas.

In all cases the priorities for dealing with emergencies follow basic life support principles.

- **Airway**
  - Airway opening, suction, airway support
- **Breathing**
  - Oxygen, bag and mask
- **Circulation**
  - Assess

Cease the procedure as safely as possible.

Get Help – Call for medical support as soon as practical.

Oversedation

Oversedation is more likely to occur at higher concentrations of Nitrous Oxide (approaching 70%) or if someone other than the child is holding the mask. If the child is holding the mask and they become oversedated then they will let the mask fall from their face in most cases. In this case recovery is usually quite rapid as the gas is excreted rapidly, provided the child has an effective airway. **In no circumstances should another person hold the mask to deliver Nitrous Oxide to the child.** If the child refuses to hold the mask or becomes unco-operative then another form of sedation/analgesia should be selected.

Should they become oversedated they will be unresponsive to verbal stimulation and may become unconscious. The most important assessment technique for the administrator is to maintain or observe verbal communication with the child throughout the procedure. If a child shows any sign of becoming oversedated then the concentration of Nitrous Oxide should be reduced.

Treatment of oversedation is to maintain the child’s airway and provide supplemental oxygen until the child excretes the N\textsubscript{2}O. Recovery should be quick due to the rapid excretion of Nitrous Oxide. Supplemental oxygen is supplied by turning the regulator to 100% oxygen on the Quantiflex machine and giving an oxygen purge through the line. This must be done if the child ceases using the mask for 30 seconds or more during the procedure as well as at the end of the procedure. Once the child has recovered their level of consciousness the procedure can recommence utilising the 50:50 mix of Nitrous oxide and Oxygen.

Remember: Nitrous Oxide is breathed off very quickly – therefore analgesia, anti
anxiolytic and amnesic properties are also lost for the period that the child is not using the Nitrous Oxide. Stop the procedure and only recommence when the child has recommenced Nitrous Oxide.

Vomiting
Vomiting constitutes a potential airway emergency. The procedure should be temporarily halted while the vomiting episode is managed. The airway must be maintained by clearing vomitus and initiating basic life support techniques. If necessary obtain medical help urgently.

Unco-operative Child
The success of the use of Nitrous Oxide depends on the child cooperating with the procedure. In all cases where the child becomes uncooperative the use of Nitrous Oxide must cease and a review of the child’s sedation/ analgesia for the procedure, should be done (Scottish Intercollegiate Guidelines Network, 2004). This may necessitate the procedure being temporarily halted. Careful explanations of the procedure to the child and family and good selection of children for procedures will help minimise the risk of this.

Recovery
Immediately following cessation of N2O therapy the child should have 100% Oxygen delivered via the mask for 3 – 5 minutes. This is to avoid Diffusion hypoxaemia. Nursing staff should then remain with the child until they have fully recovered from the sedation. This usually occurs within 5 minutes following the return to 100% Oxygen.

Prior to discharge -
- Patients should be alert and orientated.
- Vital signs should be stable and within normal limits.
- Patients should meet the criteria for discharge for sedation procedures if going home and have rested for at least 30 minutes post procedure to allow for full recovery
- Parents should be given any required discharge documentation

Documentation
Vital signs before and during administration should be recorded (Babl et al, 2005). Following the procedure it should be appropriately documented in the child’s medical record. This record should have the date and time of the procedure, the rationale for using Nitrous Oxide and the procedure performed, the concentration of Nitrous Oxide used, the length of time the procedure took, the efficacy of Nitrous Oxide use and the name of the person who administered the Nitrous Oxide (Bruce, 2003).

The record of administration should be signed on the drug chart next to the appropriate order.

Staff should record the administration on their personal record of administration for annual re-accreditation.

Disposal of Equipment
Research indicates that anaesthetic equipment presents a significant cross infection risk for patients in hospital (Chilvers and Weisz, 2000). All masks should have a
microbiological filter fitted during administration of Nitrous Oxide (Babl et al, 2005; Division of Nursing, 2001). These come attached to the prepackaged masks and tubing. Masks and tubing are disposable and obtained from the hospital’s stores department. After hours they are available from labour ward or DEM.

All masks are single use only and are to be disposed of following usage in yellow hazardous waste disposal bags. If a child is having repeated procedures on consecutive days then the same tubing mouthpiece set maybe used providing the filter remains dry. If such is to be reused the mouthpiece should be swabbed with 70% alcohol and 30% distilled water between use as per manufacturers guidelines (Dowling, 2006)
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